

Kennedy Space Center Medical Operations and Medical Kit

**Philip Scarpa, MD
Medical Operations Manager, KSC**



Space Transportation System

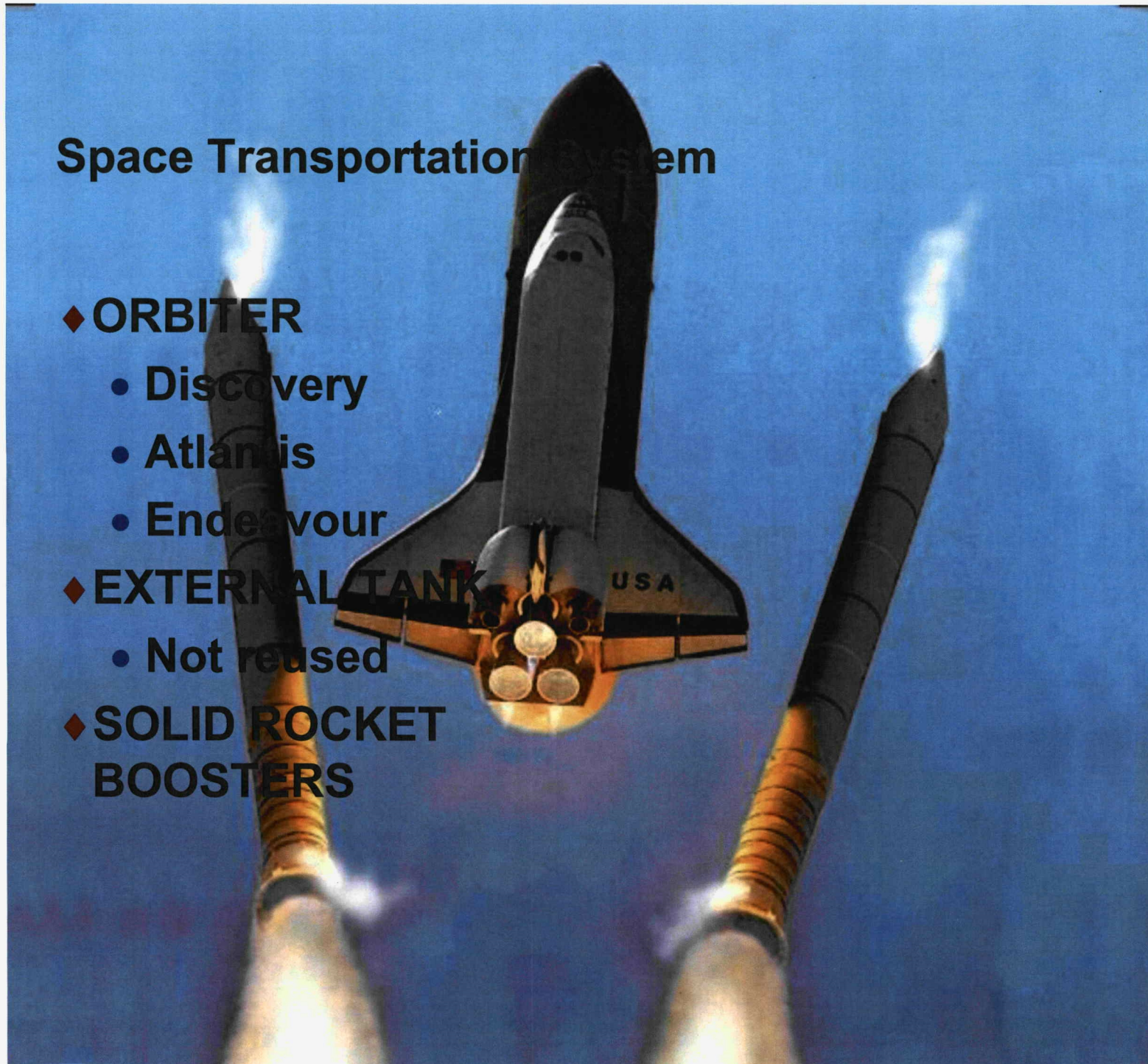
◆ ORBITER

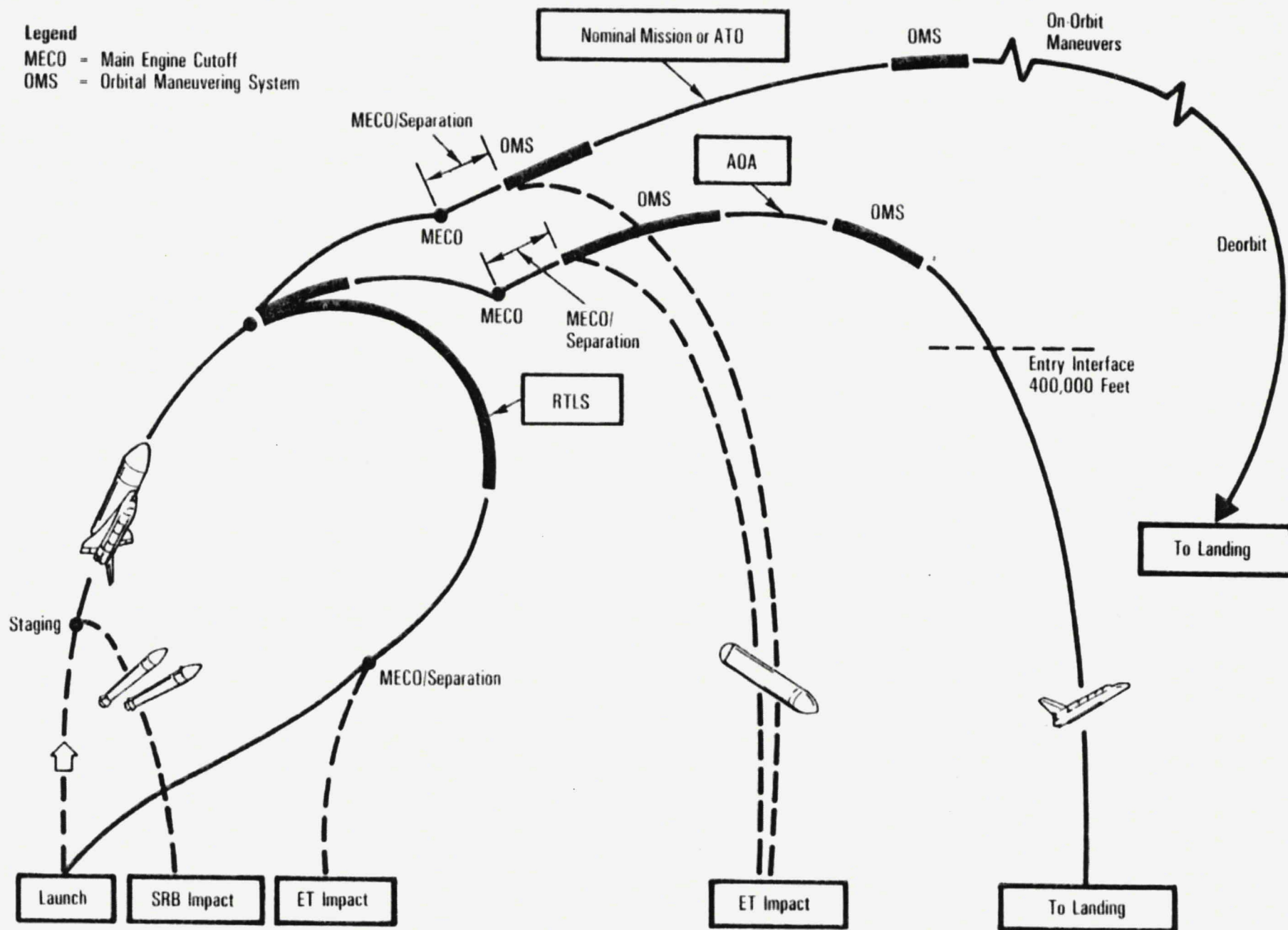
- Discovery
- Atlantis
- Endeavour

◆ EXTERNAL TANK

- Not reused

◆ SOLID ROCKET BOOSTERS





Abort and Normal Mission Profile



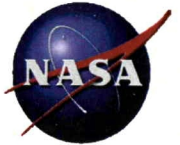
Potential Injuries to Astronauts



- ◆ **FALLS**
- ◆ **BURNS- FIRE**
- ◆ **BLAST / EXPLOSION**
- ◆ **TOXIC CHEMICAL EXPOSURES**
- ◆ **DECELERATION / IMPACT**
- ◆ **DECOMPRESSION**
- ◆ **HYPOXIA – GH2, GN2 purges**
- ◆ **HYPOTHERMIA**
- ◆ **POST-FLIGHT ISSUES**



EMS Flow



◆ **MODE DECLARATION**

- Identifying the problem
- Initiating response

◆ **RESCUE/EGRESS**

- Transfer to triage site

◆ **TRIAGE**

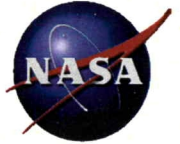
- Decontamination, initial tx and stabilization

◆ **MEDEVAC**

- Ground or Air



EMS Flow



◆ **MODE DECLARATION**

- Identifying the problem
- Initiating response

◆ **RESCUE/EGRESS**

- Transfer to triage site

◆ **TRIAGE**

- Decontamination, initial tx and stabilization

◆ **MEDEVAC**

- Ground or Air



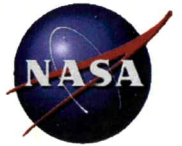
LAUNCH Contingency Modes



- ◆ **MODE 1** - PRELAUNCH – UNAIDED EGRESS AND ESCAPE (6/7).
- ◆ **MODE 2** - PRELAUNCH - EGRESS AND ESCAPE AIDED BY CLOSEOUT CREW (6/7 + 6).
- ◆ **MODE 3** - PRELAUNCH - EGRESS AND ESCAPE AIDED BY PAD RESCUE TEAM (6/7 + 7).
- ◆ **MODE 4** - PRELAUNCH - EGRESS AND ESCAPE AIDED BY PAD RESCUE TEAM, CLOSEOUT CREW ON STATION (6/7 + 7 + 7).



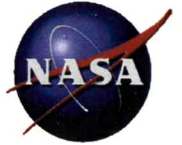
LANDING Contingency Modes



- ◆ **MODE 5** - UNAIDED EGRESS AND RESCUE.
- ◆ **MODE 6** - AIDED EGRESS AND ESCAPE FOLLOWING A MISHAP ON OR NEAR THE SLF RUNWAY.
- ◆ **MODE 7** - AIDED EGRESS AND ESCAPE FOLLOWING A MISHAP IN A REMOTE AREA.
- ◆ **MODE 8** - EGRESS AND ESCAPE IN FLIGHT (BAILOUT).



EMS Flow



◆ **MODE DECLARATION**

- Identifying the problem
- Initiating response

◆ **RESCUE/EGRESS**

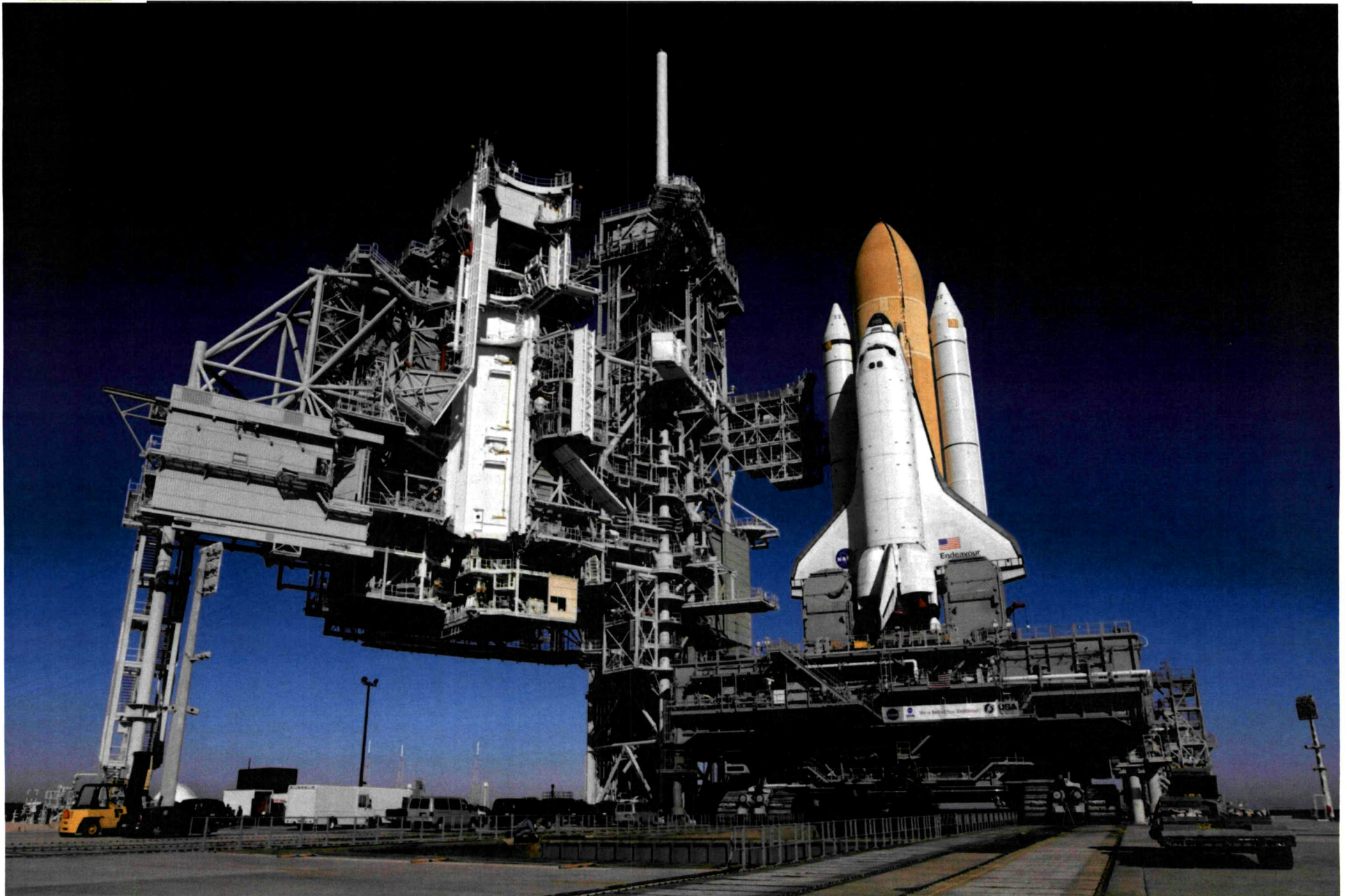
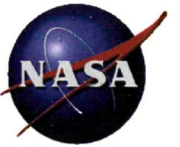
- Rescue and Transfer to triage site

◆ **TRIAGE**

- Decontamination, initial tx and stabilization

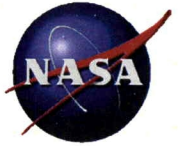
◆ **MEDEVAC**

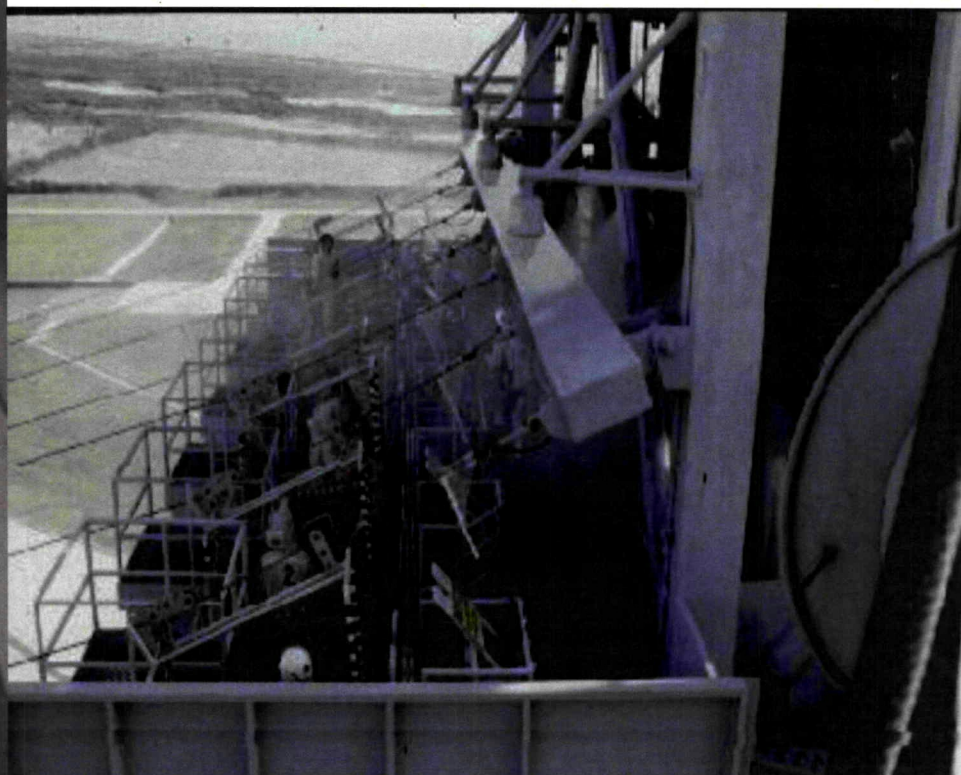
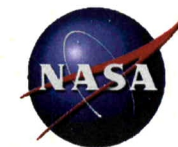
- Ground or Air

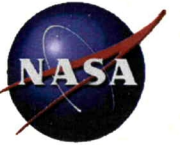


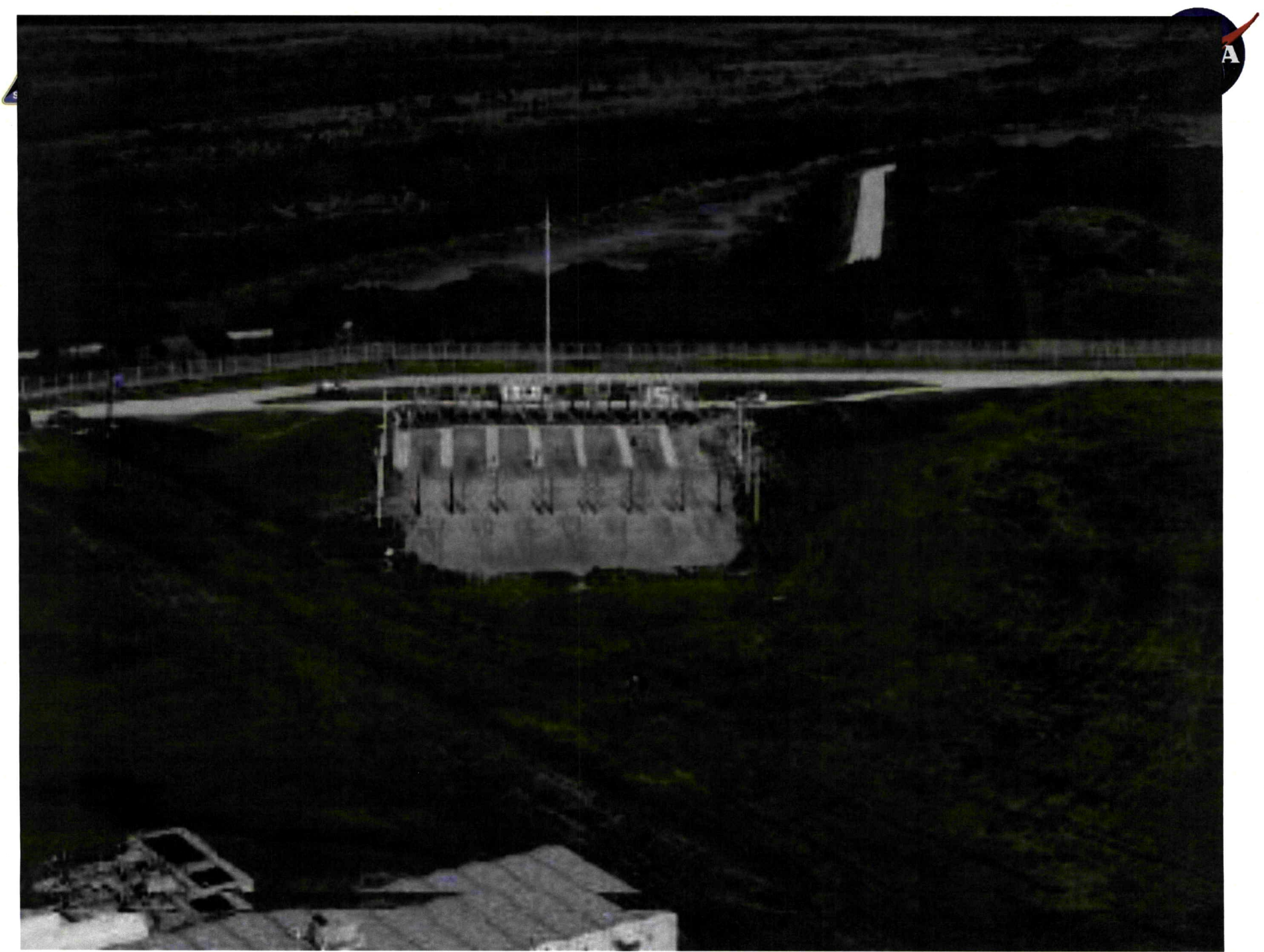


Mode 1





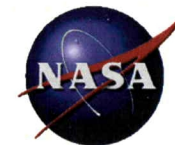








Mode 2

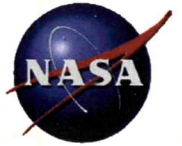






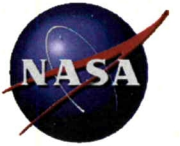


Mode 3 & 4

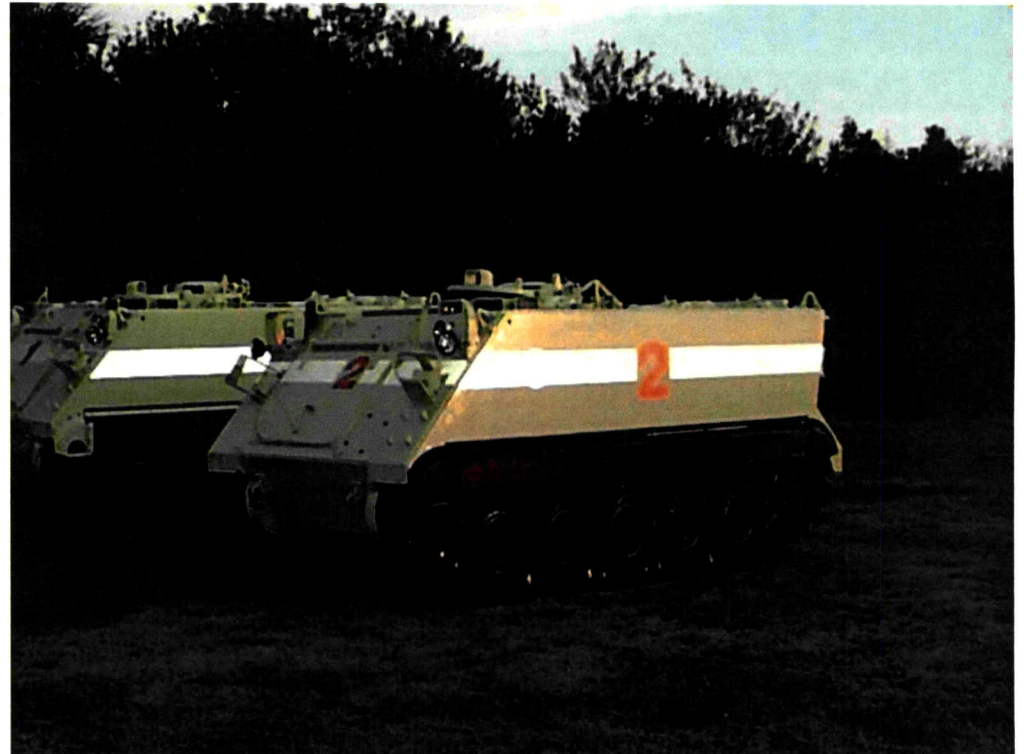




RESCUE FORCES – Pad Launch Modes



- Pad Rescue Team
- 14 Fire/Rescue Spec.
(7 up to Tower)
- 2 Armored Personnel
Carriers

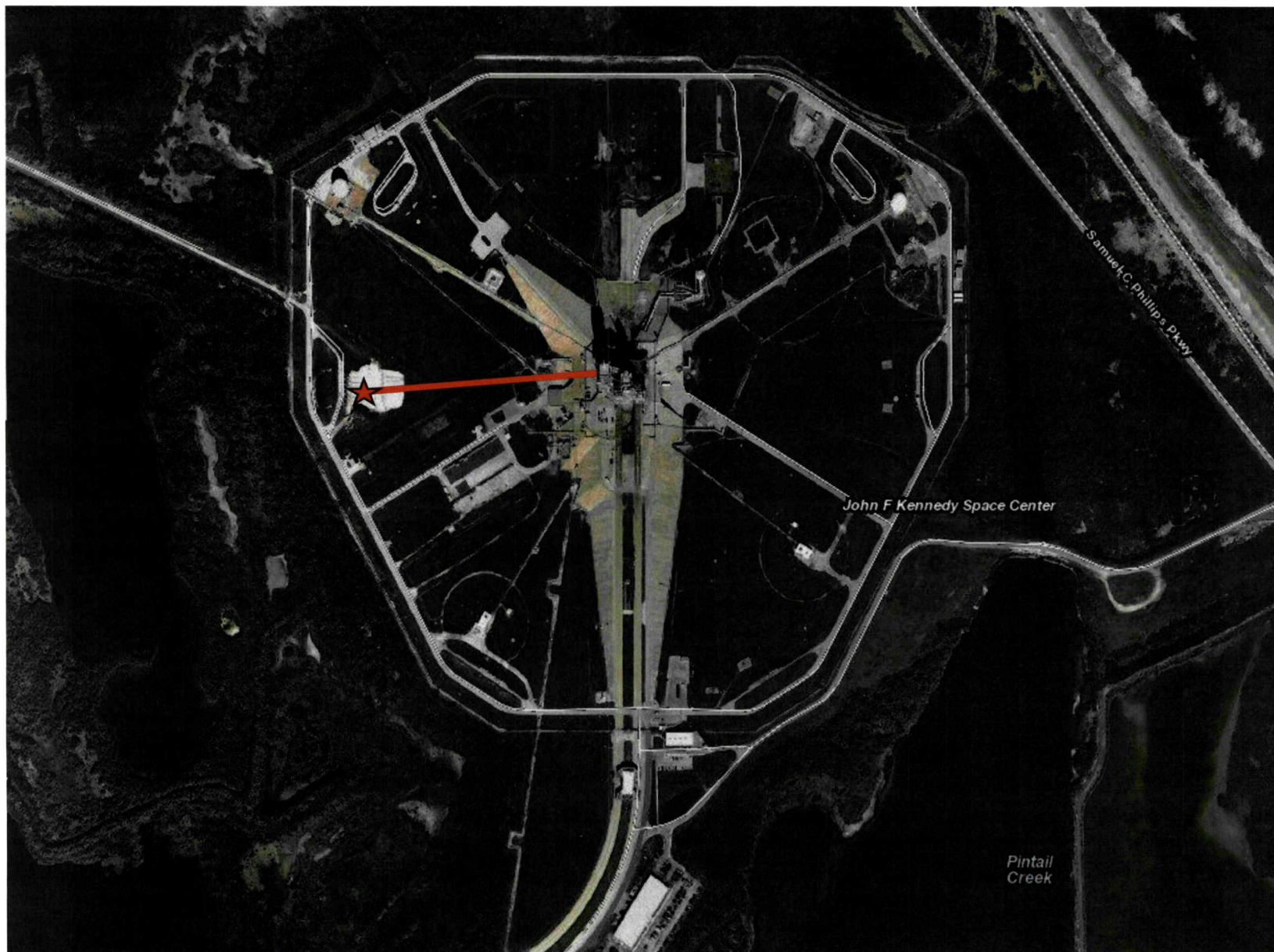
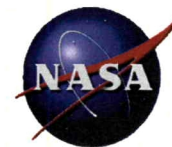








Pad Emergency Escape Slide Wire System







Pad to Bunker to Triage Site



Launch Tower

Slide wire System
to Bunker



Bunker Ops

Fire & Rescue
from
fallback location



Triage Site

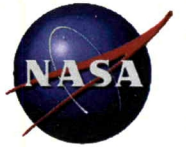


M113 to Triage Site



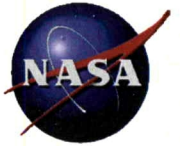
Exit Bunker and Enter M113







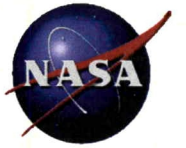
Mode 5





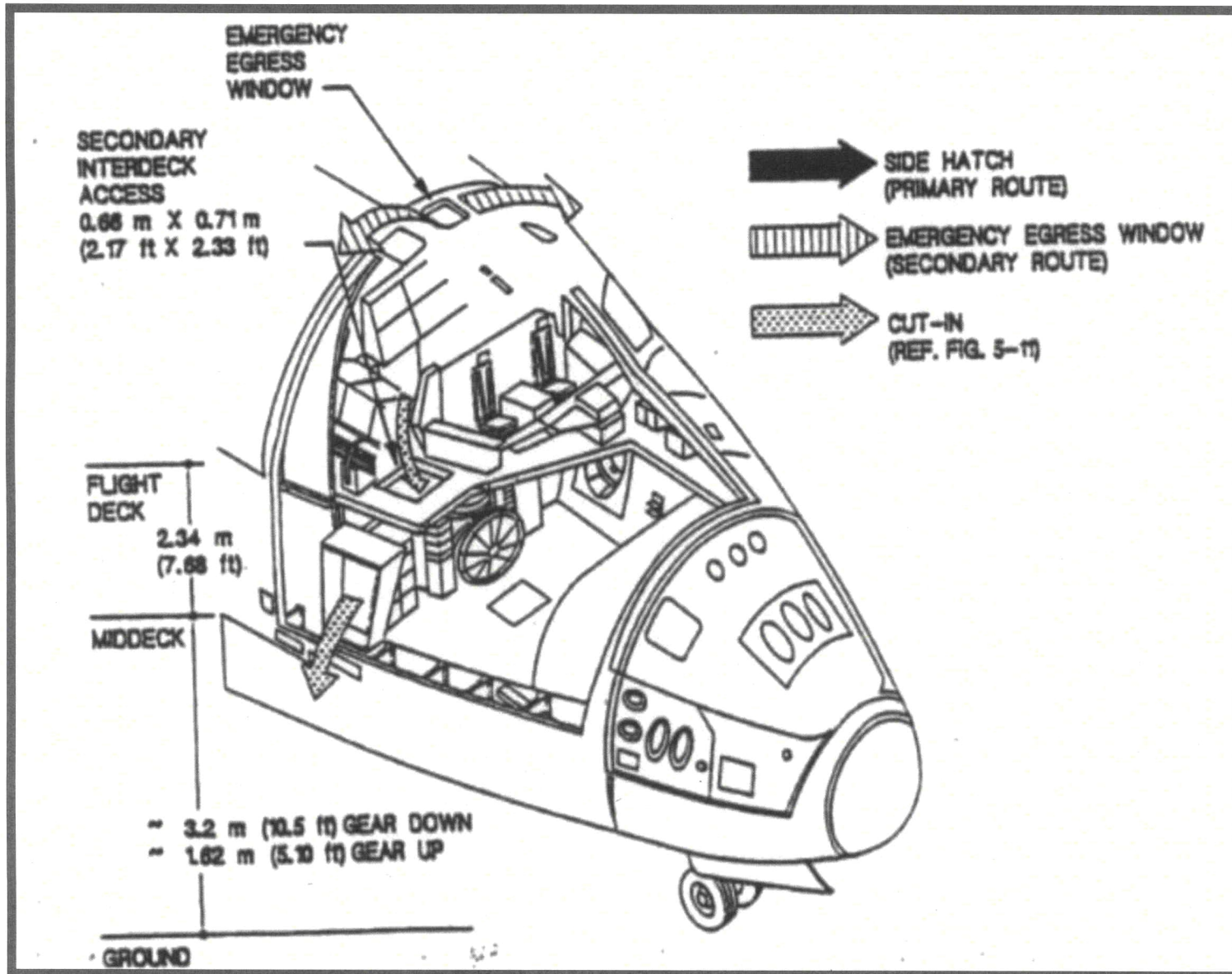
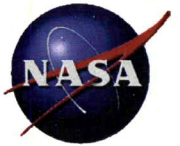


Mode 6



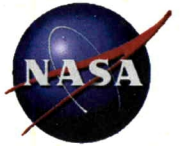


SHUTTLE EGRESS

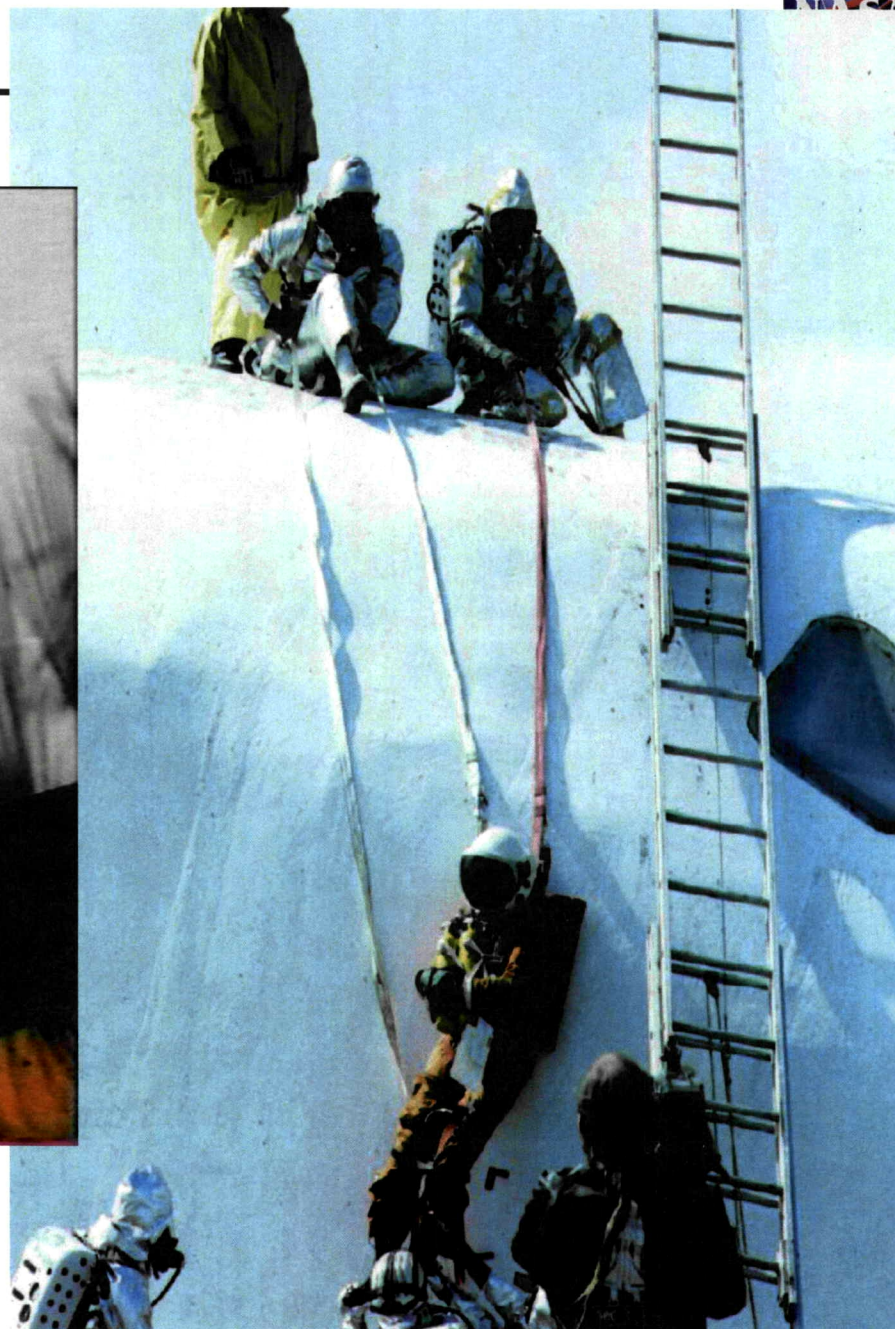
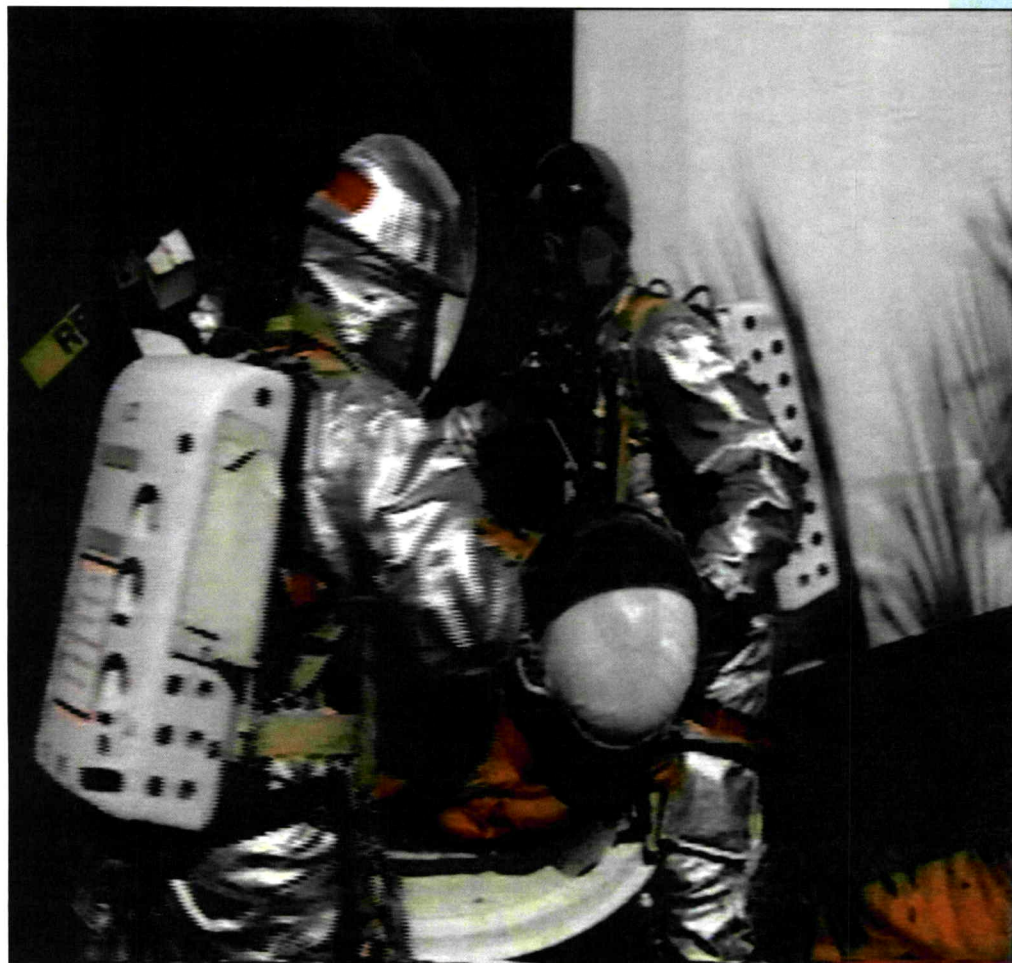
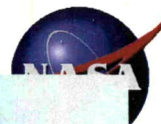




Mode 6 Rescue Forces



- **14 Fire/Rescue Spec.**
- **Van**





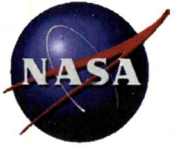
Mode 7







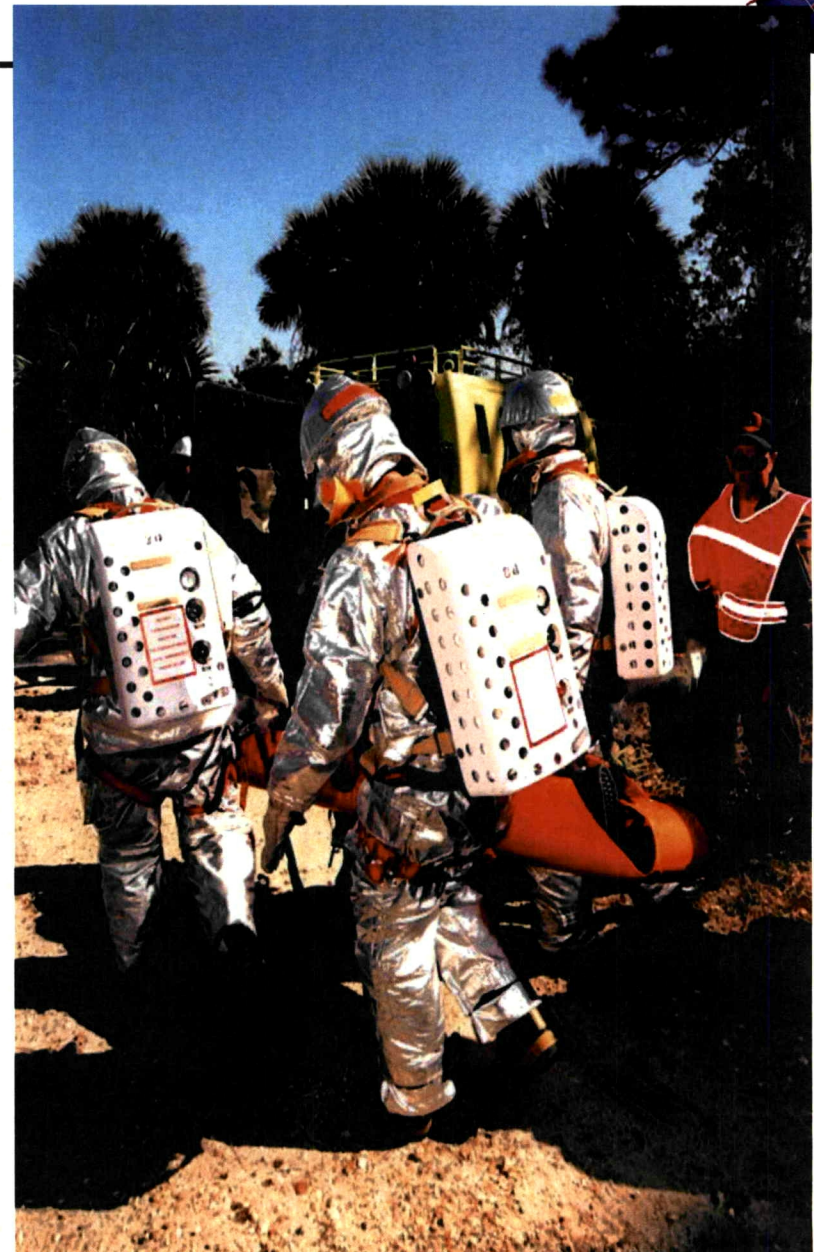
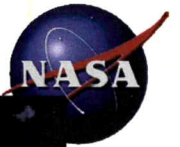
Mode 7 – Rescue Forces

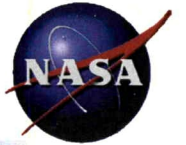


- 14 Fire/Rescue Spec.
- Bearcat
- Helo

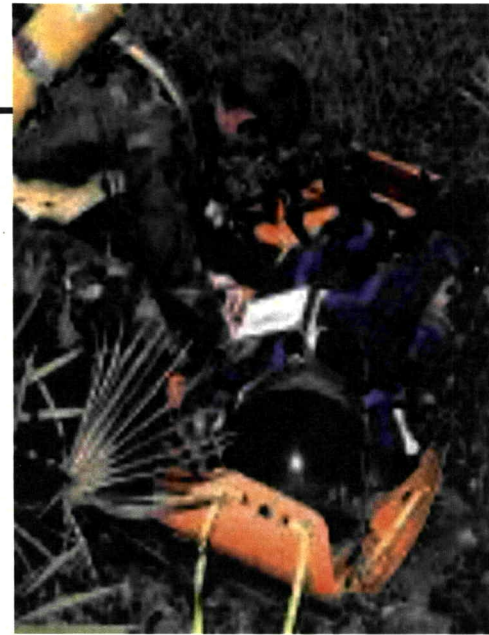
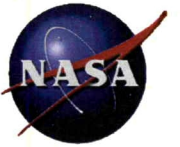








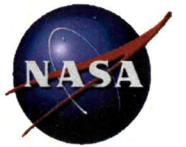






Mode 8







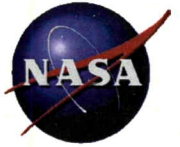
Mode 8 - Rescue







EMS Flow



◆ **MODE DECLARATION**

- Identifying the problem
- Initiating response

◆ **RESCUE/EGRESS**

- Transfer to triage site

◆ **TRIAGE**

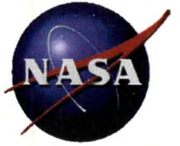
- Decontamination, initial tx and stabilization

◆ **MEDEVAC**

- Ground or Air



Triage Site Selection



- Wind Direction
- Proximity to contingency



Triage Site – Launch Modes 1- 4



125 ft Helo
pad clearance



Treatment Area

MOVING VEHICLES
PARKED
VEHICLES/PERSONNEL

Decontamination
Area

Clean-Dirty
Line



Washdown Truck



To Pad



Triage Site – Landing Modes 5 & 6



125 ft Helo
pad clearance



Treatment Area

Clean-Dirty
Line

MOVING VEHICLES
PARKED
VEHICLES/PERSONNEL

Decontamination
Area



Rescue Vans



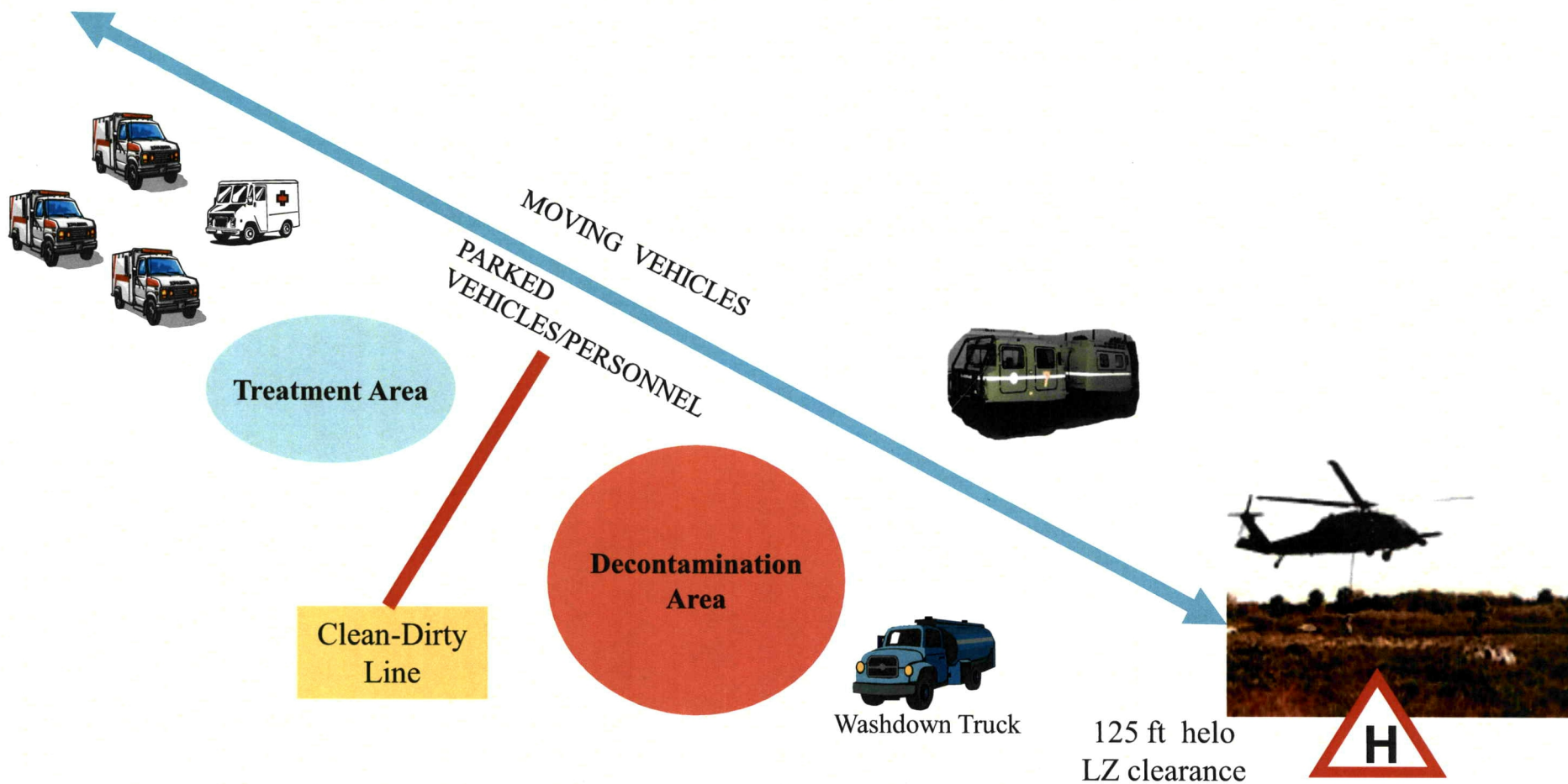
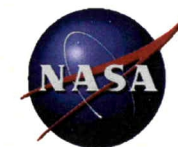
Washdown Truck



To Orbiter



Triage Site – Mode 7 & 8





Triage Site Forces

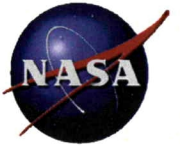


- Triage Doc
- Trauma Docs (2)
- Crew Surgeon
- Paramedics (4)
- Ambulances (2-3)
- Medical Communicator
- Logistics Coordinator
- Triage Van
- Environmental Health
- Washdown Truck
- Lighting Truck





Triage Doc



- ◆ KSC Physician
- ◆ Command and Control of Triage Site
- ◆ Radio and Wireless Telecommunication with EMSC in LCC





Univ of FL Trauma Docs

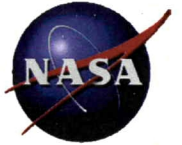


- ◆ Trauma Surgeons/
ER/Anesthesiology
- ◆ UF Shands/Jacksonville
and Gainesville
- ◆ Provide ATLS expertise
- ◆ 4 for every Launch





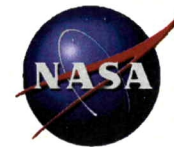
Flight Crew Surgeons



- ◆ Astronaut's PMD
- ◆ Launch
 - CS at Triage Site
 - DCS with EMSC in LCC
- ◆ Landing
 - CS and DCS in CTV



Triage Site - Decon Area



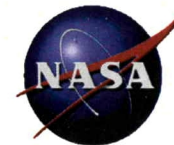
EH Specialists "Sniffing"
Advance Paramedics "Assessing"



Firefighter "Washing"



Triage Site - Treatment Area

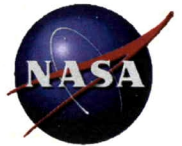


Evaluation and Treatment by
Paramedics and Trauma Docs





Mode 7 & 8 – Triage Site vs Direct to Hospital



In Modes 7 & 8 Air Doc can assess and choose Triage Site or go to Hospital

Directly to Hospital – To minimize delay if survivable, need for surgery, neuro trauma, DCS, imaging other than US.

Triage Site – nearby, trauma surgeons, need for further decon, toxicology expertise, extra resources (equipment, IV fluids, meds, personnel, crew surgeons), unable to do needed procedures in helo, initial stabilization if think patient unlikely to survive trip to hospital (some transports to Level I DMCFs can be ~1hr with ground transport arms or distance), med code zeros.



EMS Flow



◆ **MODE DECLARATION**

- Identifying the problem
- Initiating response

◆ **RESCUE/EGRESS**

- Transfer to triage site

◆ **TRIAGE**

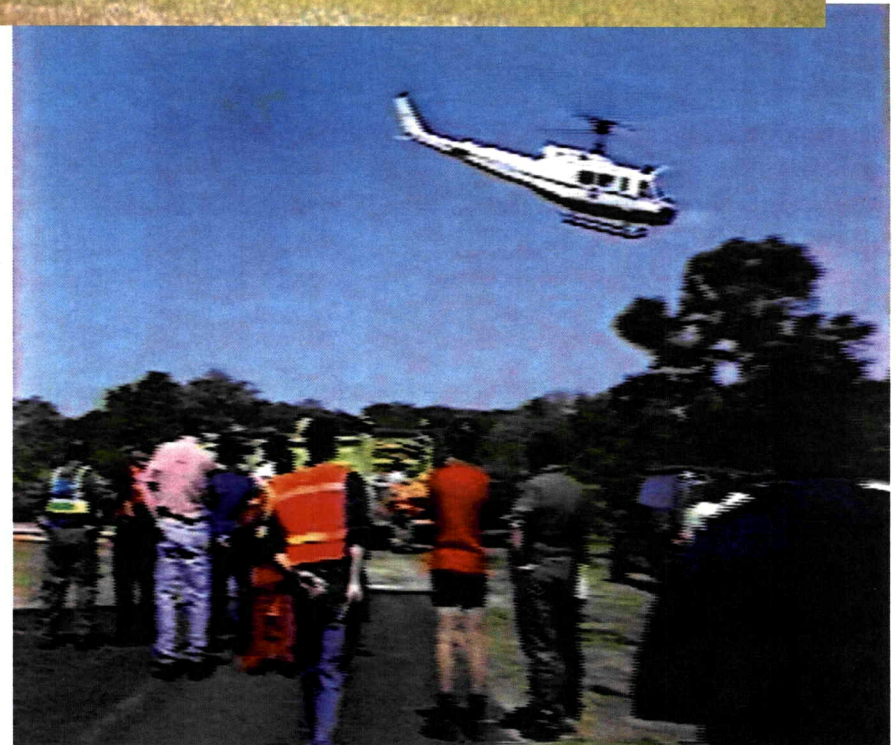
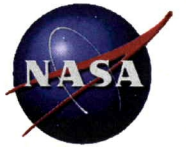
- Decontamination, initial tx and stabilization

◆ **MEDEVAC**

- Ground or Air



Air Medevac





Air Medevac Forces



DoD HH-60 Helicopters (2)

- 1 "AirDoc" and 2 "PJs" per helo
- Carries 2 patients

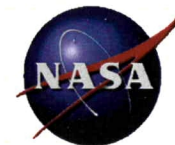


NASA Hueys (2)

- 2 Paramedics
- 1 Doc
- Carries 2 patients



Transport Officer



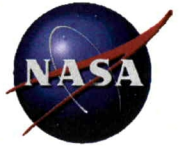
- Coordinates all traffic into and out of the Triage Site
- Usually a KSC Fire Chief
- Designates and Polices the LZ
- Assures proper patient handling and transport to/from vehicles
- Communicates activity with Medical forces and EMSC







Community Helicopters



First Flight

- Holmes Regional



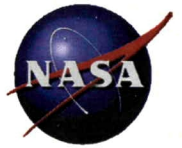
AirCare

- ORMC



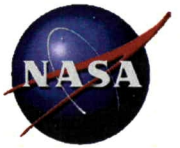


Definitive Medical Care





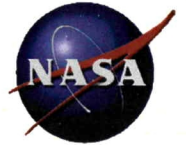
Medical Care Facilities Supporting KSC



- ◆ 6 Definitive MCFs
- ◆ 1 Intermediate MCF
- ◆ 2 Alternate MCFs



Additional Medical Forces



◆ KSC Clinic

- KSC Medical Dispatch
- Trauma Docs (2)
- Ambulance (1)
- Paramedics (4)
- Nurses/MDs
- NASA "Search 2" Helo

◆ Biomed Offices

- "KMD" (2)
- "KRN" (1-2)
- Clinical Lab

◆ SLF

- Ambulance (2 adv PM), Washdown truck

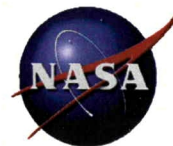
◆ EHF Command Post

◆ Fire Station 1 at CCAFS (2 ambulances)

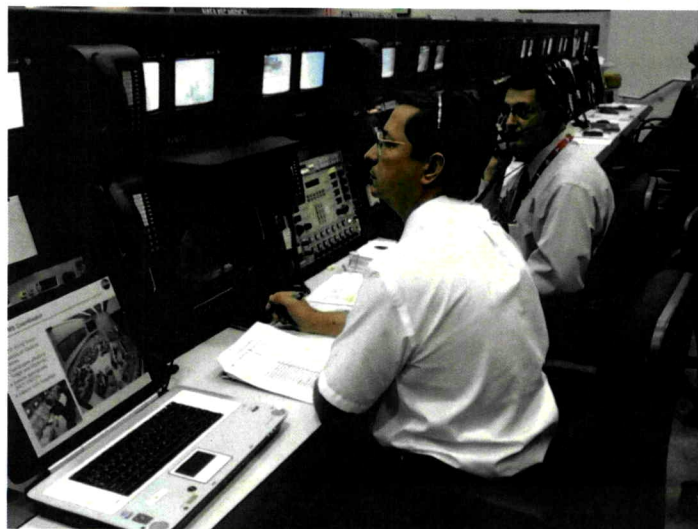
◆ Visitor support (RNs and EMTs)



EMS Coordinator and CBSE

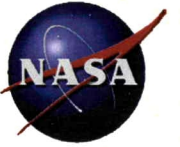


- ◆ In LCC Firing Room
- ◆ Controls all Medical Forces
- ◆ Coordinates Triage and Medevac (with DOD Surg in Modes 7&8)
- ◆ Selects appropriate IMCF/DMCFs
- ◆ Liaison with Hospitals/EOCs





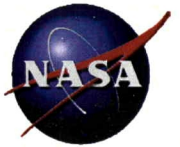
NASA/DOD Helo Medical Kit



- Medication Bag (Specific medication uses)
- RSI Bag (NASA RSI protocols)
- Air Doc Medical Kit (Bag)



Medication Bag

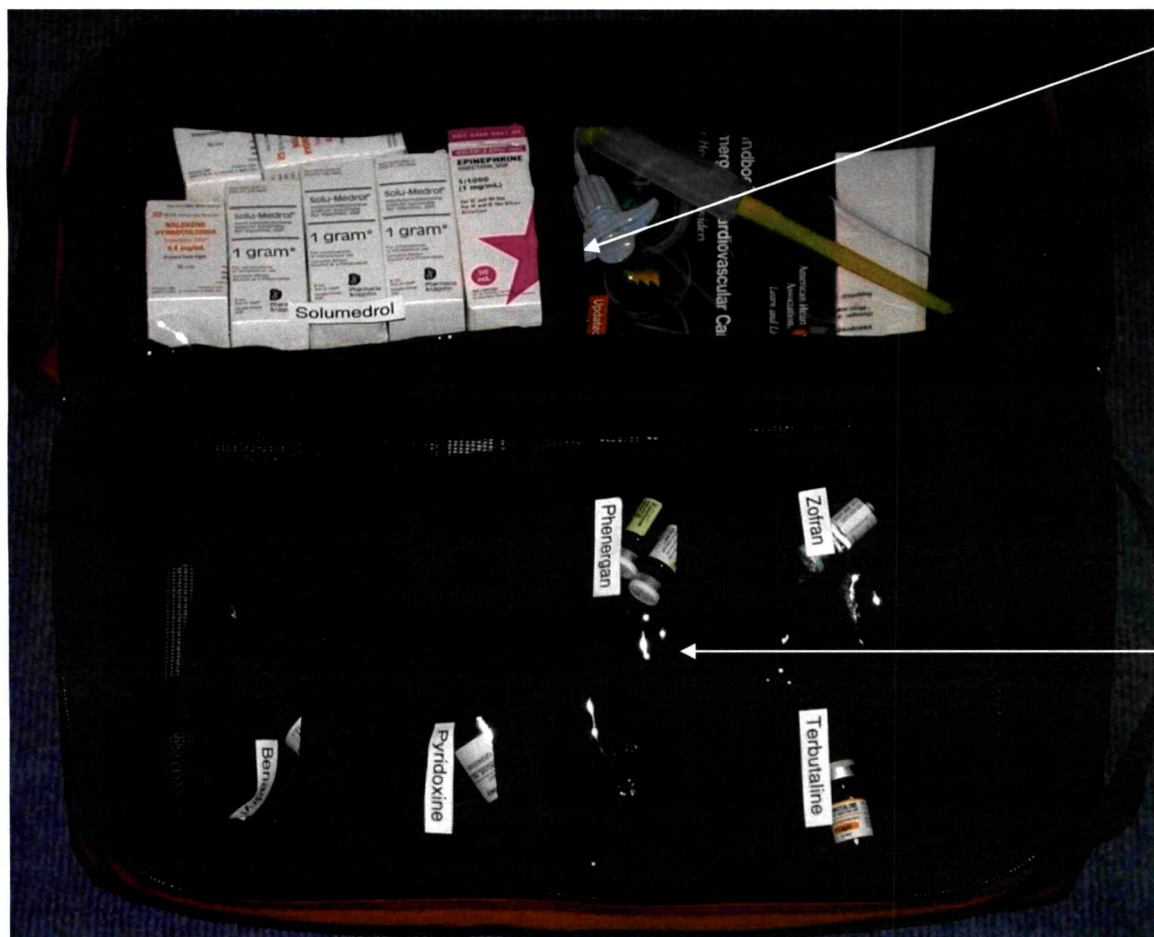


Bag External





Medication Bag



Top of bag

(two clear plastic sections)

Solumedrol

Narcan

Epi vial- 1:1000

Pack contents list

ACLS med guide

Treatment cards

External Flap

Zofran

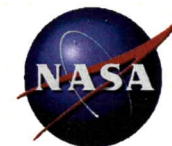
Phenergan

Terbutaline

Pyridoxine (Vit B₆) IM or IV drip



Medication Bag



Inside bag under mesh cover

ACLS and other meds

Epinephrine	Lasix
Lidocaine	Albuterol
Adenosine	Benadryl
Atropine	

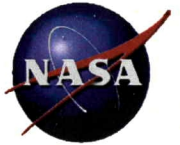
Internal side of flap

ACLS meds

Vasopressin	Lopressor
Amiodarone	Dopamine
Mg Sulfate	ASA



Medication Dosing



◆ Most meds follow

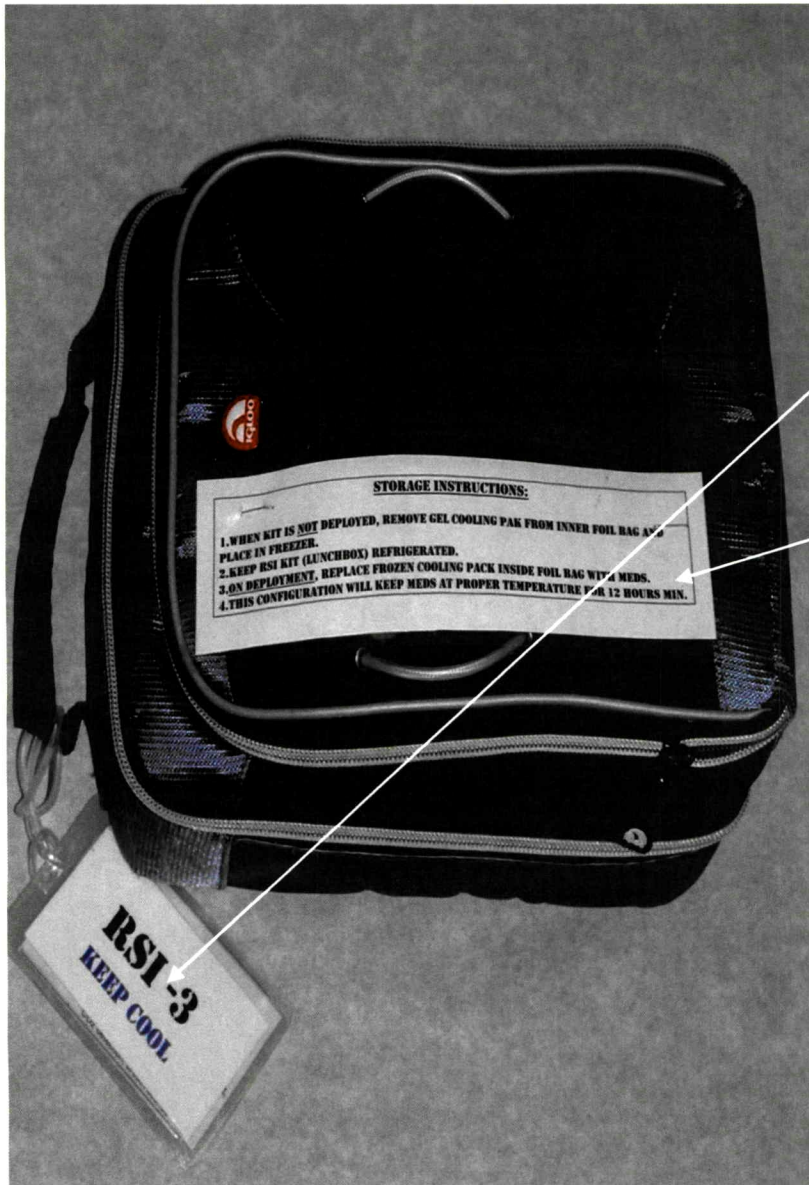
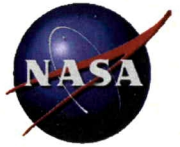
- AHA ACLS Guidelines
- Traditional drugs and dosing as on Earth

◆ NASA unique exposures

- Hydrazine
 - Pyridoxine (vitamin B₆)
 - Administer – 25 mg/kg IV over 30 to 60 minutes, one time dose
- Nitrogen Tetroxide
 - Solumedrol
 - Administer – 30 mg/kg IVP over 10 minutes, then Q6hr



RSI Bag



Outside of Bag

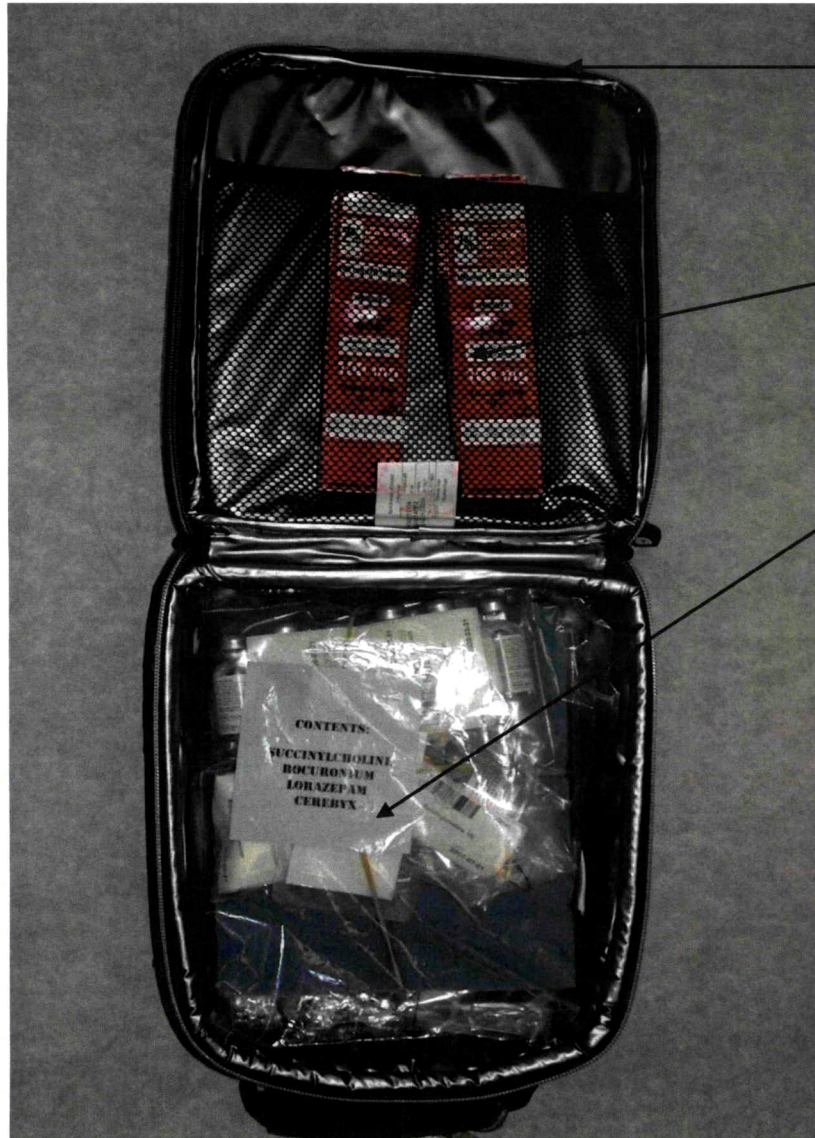
Label of Bag number on handle

Instructions for storage

Configured for deployment
Ice bag inside



RSI Bag



Outside Pocket

Etomidate

Inside Flap

Lidocaine

Inside Foil Packet

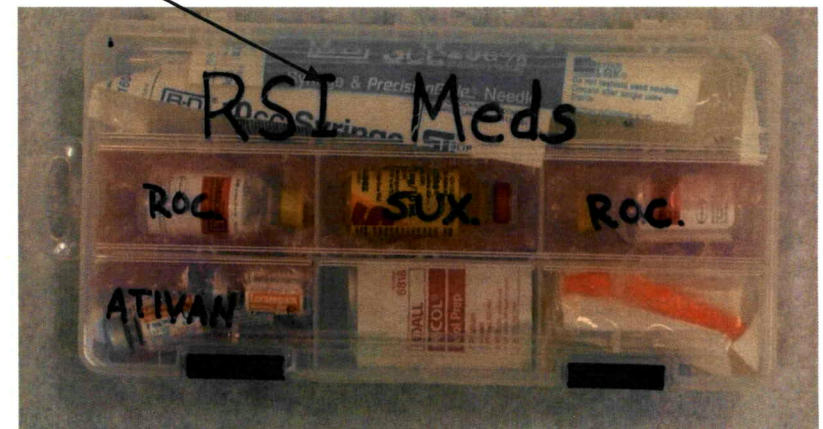
Succinylcholine

Rocuronium

Ativan

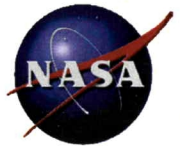
Cerebryx
(cool)

Diltiazem
(cool)





NASA Specific RSI Protocols



◆ Based on NASA Anesthesia Summit in 5/2003

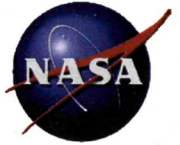
- Astronaut on return tx different: sensitivity to anesthetics, pain meds, sedatives, depolarizing agents
 - Avoid Thiopental, Propofol, Ketamine, Morphine Sulfate (cardiac depression and vasodilation)
 - Avoid cell membrane depolarizing agents (eg, Succinylcholine)
 - Consider Lidocaine in all RSIs to protect the heart
 - Start all meds at lowest range and redose as necessary

◆ RSI

- Pre-flight = Lido, Etom, Sux
- Post-flight or Head/Burns/Crush/Eye = Lido, Etom, Roc
- RSI use is based on competency



Air Doc Medical Kit (Bag)

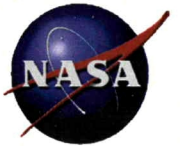


◆ Periphery=Circulation

◆ Inner=Airway/
Breathing



Air Doc Trauma Kit (Bag)



Left Side

Saline 1000ml
Ringers 1000ml
IV Tubing
IV Catheters
IV Start kit



Bottom Compartment

F.A.S.T IO Kit
14 ga CV cath
Sterile Gloves
Syringes, Needles, Tape

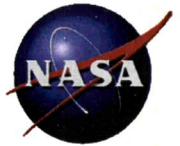


Right Side

Dopamine
Lidocaine
Mannitol 20% 500ml
Saline 100ml
Saline 250 ml
36 fr Chest Tube



Air Doc Trauma Kit (Bag)

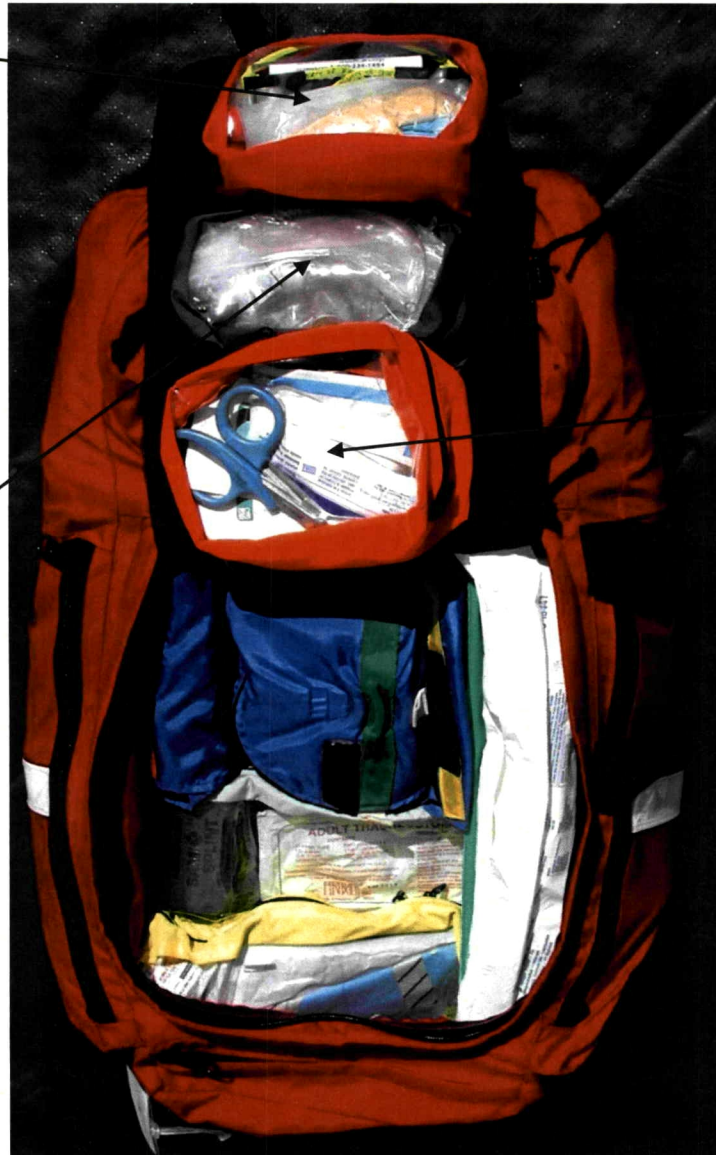


Precautions/Red

Sharps shuttle
Goggles
Exam Gloves
Bio haz bag
Mask

Airway acc/Grey

Y-Connector
Nasal Cannula
Non Rebreather mask



Miscellaneous/ Orange

Gauze
Eye pads
Adaptic dressing
Epistaxis sponge
Foley Cath
Trauma shears



Air Doc Trauma Kit (Bag)



Airway Kit/Blue

Yellow Stripe

ET Tubes

Green Stripe

Ambu w/mask

Oral Airways

CO2 Detector

Waterproof tape

Red Stripe

Laryngoscope

Blades

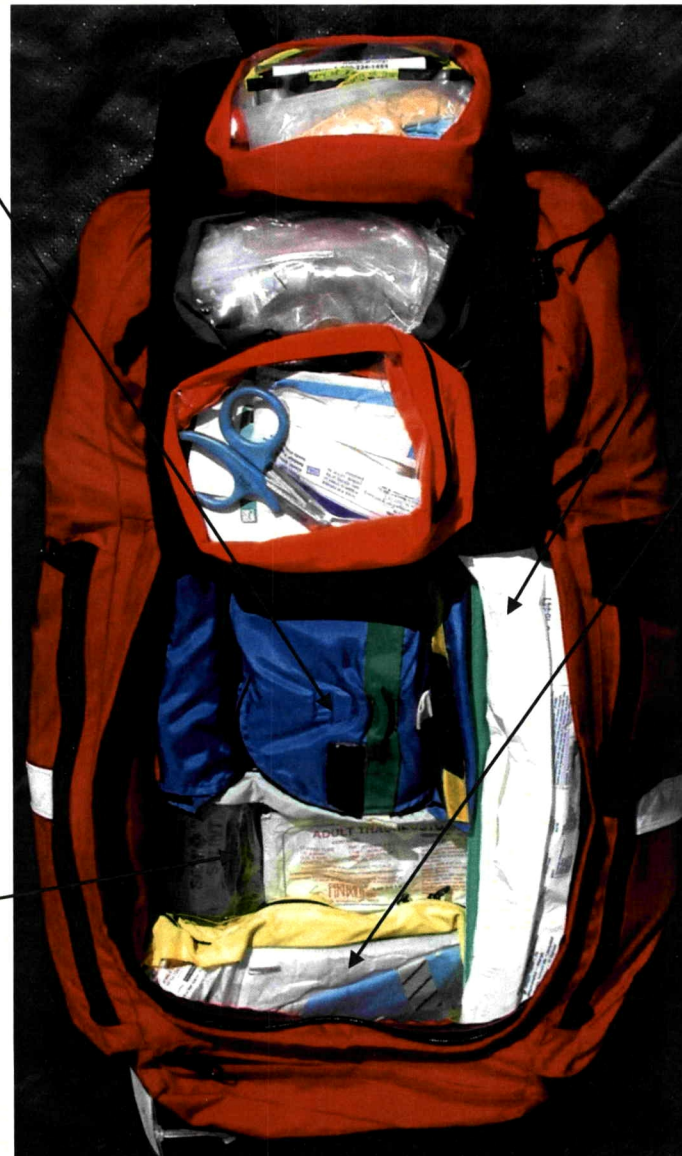
10cc Syringe

Lido Jelly

Grey

Sam Splint

Tracheostomy kit



Interior (side)

King Airway

Chest Tube/Yellow

Petroleum Gauze

Tape

16ga Catheter

Scalpel

Betadine Prep

Heimlich Valve

Finger Cots

Kelly clamp

Xylo 1%/Epi

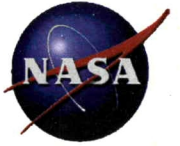
Instrument set

Suture

10cc Syringe



Summary



Introduction to:

- Local KSC EMS ops: Declaration, Rescue/Egress, Triage, Medevac
- KSC Launch and Landing Contingency Modes (1-8)
 - Mechanisms of Injury, Types of Tx needed
- Triage Site – set up, flow, resources
- Helo Medical Kit